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ABSTRACT

The purpose of the paper is first to quantify the extent of high skilled migration from India and then to distil out two of its economic implications to her home economy. First the high skilled migration has resulted in larger amount of remittances: India is now the largest remittance receiving country in the world. Although during the period up to the mid 1990s, the source of this remittances were largely the result of low skilled migration to the middle east, since that period nearly half of the remittances are emanating from the US alone and it is not difficult to argue that this trend in the shift in source is very much tied to high skilled migration. The availability of these remittances has helped the country to reduce its deficits in the current account of its Balance of Payments even if these remittances have not always found expression in productive investments in the home economy. Further the increased consumption smoothening that these remittances have contributed to have had a positive effect in spurring and maintaining the high growth performance of her services sector. The second implication is that it has had a deleterious consequence on the supply of high skilled personnel especially for R&D: in fact India has one of the lowest densities of scientists and engineers engaged in R&D. Although there are quantitative evidences (based on an analysis of both input and output indicators of innovation) to show that India has become significantly more innovative in the period since 1991, her ability to sustain and improve this performance crucially depend on the availability of highly skilled manpower of certain acceptable quality. Although a small number of such manpower is turned out by the higher education system, they do not find an expression in the core human resource on science and technology and part of this "lack of expression" may be attributed to the increased high skilled migration.

Keywords: India, high skilled, brain drain, brain circulation, remittances, science and engineering work force

JEL Codes: F22;F24;O15;O38

Introduction

The world economy is characterized by a very high level of integration. This integration or globalization as it is more popularly known is to a large extent contributed by increased trade in commodities, services, capital and indeed in movement of natural persons across nations of the world. According to the International Organizatiion of Migration (2008), there are more than 200 million migrants around the world today and there is enough evidence to show that the rate of international migration has actually increased at a time when the world is getting more globalised. The total number of citizens that have emigrated from India is about 10 million (World Bank (2008). At this it works out to just about a per cent of her population (Table 1).

India is one of those countries from where the migration rate of high skilled migrants has always been much higher than the total migration rate. For instance in 1990, the total migration rate for all education groups was 0.2 per cent. This has since increased marginally to 0.3 per cent in 2000. In the case of high skilled migrants (defined as those with at least tertiary education) was 2.6 per cent and 4.2 per cent in 1990 and 2000 respectively.

The routes through which high skilled and low skilled migration takes place differ widely. In the case of high skilled migration there are two routes: first education related and the second the employment related. In the case of low skilled migration, there is however, only one route namely the employment related route.

Table 1: Stock of emigrants from India (as on December 31 2005)

Countries	Stock of emigrants as per centage of population	Stock of Emigrants in million
Jamaica	39.1	1.04
Fiji	17.5	0.15
Lebanon	17.4	0.62
Bulgaria	12.1	0.94
Jordan	11.2	0.64
Cuba	11.05	1.29
Mexico	10.7	11.50
Russia	8	11.48
United Kingdom	7	4.16
Poland	6	2.32
Malaysia	5.8	1.46
Singapore	5.3	0.23
Srilanka	4.5	0.94
Philippines	4.4	3.63
Colombia	4.3	1.97
Chile	3.6	0.58
Iraq	3.6	1.02
Bangladesh	3.4	4.89
Egypt	3.2	2.40
Pakistan	2.2	3.42
Argentina	2.1	0.81
Venezuela	1.7	0.46
South Africa	1.5	0.71
Iran	1.4	0.97
Kenya	1.2	0.43
Thailand	1.2	0.76
India	0.9	9.99
Indonasia	0.8	1.74
United States	0.8	2.26
Nigeria	0.6	0.84
Brazil	0.6	1.14
China	0.6	7.26
Oman	0.3	0.01

Source: Ratha and Xu (2008)

Regarding high skilled migration the traditional route of migration has been the education route. Indian students go abroad for higher studies and then remain back in the host country by taking up employment. This route has now become more pronounced with more and more students going abroad for higher studies. Although we do not have good quality quantitative numbers on the number of students who have gone abroad for higher studies this trend can be indirectly gleaned through the education related travel in the current account of India's BoP tables: this used to be only about on an average about US $ 60 million per annum during the 1990s, but this has since increased to about US $ 1 billion during the period since 2000. This traditional route has been supplemented with employment related emigration. The growing globalization of the world economy in general and the growing competence of India in certain areas of technical skills such as those related to Information Technology (IT) has meant that Indian citizens with these skills are much in demand in the labour markets of especially Western countries.

This increased high skilled migration from India has at least two major implications. First the high skilled migration has resulted in larger amount of remittances. The second one is that it has had a deleterious consequence on the supply of high skilled personnel especially for R&D: in fact India has one of the lowest densities of scientists and engineers engaged in R&D.

The current thinking in the development circles is that governments of sending countries ought to be taking advantage of high skilled migration for their economies rather than put hurdles in the way of such migration. The term "brain drain" is increasingly replaced with "brain circulation". There are many instances of these high skilled migrants contributing to the well being of their home countries by providing information on markets and technology and indeed in facilitating the supply of risk capital such as venture capital which then

can be used for establishing technology-oriented ventures in their home countries.

In the context the purpose of the paper is two fold: first is to provide some estimates of the number of high skilled migrants from the country and the second objective is to map out the economic implications of this migration on certain specified dimensions of the nation's economy. I consider two dimensions, namely its implication for science and engineering work force in the country and second in terms of private transfers that have been very helpful in containing India's current account deficits.

The paper is structured into four sections. In the first section I attempt at an engagement with the literature on high skilled migration. This is followed by surveying the extent to which high skilled migration has actually increased from the country since 1991. The third section discusses the economic implications of this high skilled migration in terms of the two dimensions that I discussed earlier. The fourth and the final section sums up the main findings of the study.

I. Engagement with the literature

The literature on movement of natural persons across borders have assumed much importance in the context of changes in the international governance rules dealing with such movements and not least through the process of globalization which seems to have made the labour markets in most countries somewhat more integrated. A subset of this literature is the one on movement of highly skilled individuals across borders and especially from southern countries to northern ones. There are three main issues that are discernible: first the size of this movement, second, the determinants and third the various economic implications of this movement on both the sending and receiving countries. Regarding specific literature in the context of India, Khadria (1999) is an important work. His research explained the changing attitude towards migration

in India, where the discussions have evolved from focusing on the "brain drain", to becoming a "brain bank", to achieving a "brain gain". Among the three the least explored is the last one. Economic implications are multi dimensional in nature. One implication that has attracted some systematic inquiry is the fiscal implication. In the global context Hanson (2008), selectively discuss recent empirical work on the consequences of global labor mobility. He examines how international migration affects the incomes of individuals in sending and receiving countries and of migrants themselves. Within the specific Indian context, an important work in this area is by Desai et al (2009). In this study in order to calculate the fiscal losses associated with these emigrants, estimates of their counterfactual earnings distributions are generated using two distinct methods and integrated with a model of the Indian fiscal system to calculate fiscal consequences. Conservative estimates indicate that the annual net fiscal impact to India of high-skilled emigration to the U.S. is one-half of 1% of gross national income (or 2.5% of total fiscal revenues). In the light of this the present study seeks to fill in gaps with regard to the first issue of putting some numbers on the number of skilled workers moving from India, the routes of such migration and the effect of these migration on India's economy.

II. Estimates of high skilled migration

Although the term highly skilled immigrants became a mantra in public and policy discourses in recent years especially the West, a review of the academic and policy literature indicates that there is no consistent definition or measurement of highly skilled. According to Lowell and Batalova (2006) the reasons for this gap in literature largely fall into two groups: data-related and conceptual. One example to streamline the definition of highly skilled workers across various national contexts is the Canberra Manuel definition of Human Resources in Science and Technology (HRST). This measure, collaboratively constructed by the OECD and European Commission/Eurostat, is based on two dimensions:

qualification (tertiary level or better education) and occupation (training/ employment in a science and technology occupations) (OECD 1995). The International Organization of Migration (2008) in its fourt report on world migration also adopts a similar definition. According to the Canberra manual, HRST are individuals who satisfy one or other of the two requirements of education and employment:

i. successfully completed education at the third level in an Science & Technology (S&T) field of study; and

ii. not formally qualified as above, but (currently) employed in a S&T occupation where the above qualifications are normally required.

Although it may be possible to estimate the domestic supply of highly skilled personnel and in fact these estimates do exist at the national levels, it is not easy to have estimates of migration of highly skilled personnel embodying both (i) and (ii). The only exception that I know of is the United States' well-known specialty worker H-1B visa programme as it is based on a list of occupations and a minimum degree requirement of a baccalaureate.

In the following, I discuss first various estimates of high skilled migration from India and then analyse the possible routes through which this process has taken place. Regarding estimates I present some direct estimates followed by a limited number of indirect estimates.

Direct estimates of high skilled migration: According to the *World Bank Migration and Remittances Factbook* (Ratha and Xu, 2008*),* the total stock of emigrants from the country in 2005 was about 10 million and as percentage of the country's population this works out to about 1 per cent. There is now some quantitative evidence to show that high skilled migration from India has increased in the 1990s compared to earlier periods and also the rate of migration of high skilled population is higher than that for low skilled migration (Table 2). In fact the

migration rate of high skilled personnel (defined as those with tertiary education) is significantly higher than all other groups: for instance the total migration rate was just 0.3 per cent while those high skilled was 4.2 per cent.

Table 2: Migration rate of high skilled personnel from India, 1990-2000 (in per cent)

Situation in 1990				Situation in 2000			
Primary educated	Secondary educated	Tertiary educated	All education groups	Primary educated	Secondary educated	Tertiary educated	All education groups
0.1	0.2	2.6	0.2	0.1	0.3	4.2	0.3

Source: Docquier and Marfouk (2004)

The high skilled migration from India consists of two kinds: physicians and non-physicians. See Table 3. At this number it is close to 4 per cent of those trained within the country. Within non-physicians, a category that has become very prominent is the IT and IT related migrants primarily to the United States. Most of these IT related migration to the USA has been through the H-1B route. Those proceeding on H-1B visas are temporary migrants as they are technically allowed to remain in the United States only for six years or so. Considering their temporary nature they do maintain their families back home in India to whom they periodically remit portion of their savings abroad. This is the main reason as to why remittances to India are high even when the skill content of migration has actually increased to encompass more highly skilled migrants. Such large scale migration of high skilled workers from India has both positive and negative effects. On the positive side, as considered above, the remittances sent by the migrants have been an important source of support for reducing the deficit on the current account of our BoP. Further they have been the source of technology, capital and markets for some of the high technology industries such as

Table 3: Number of physicians who have emigrated, c2000 (in thousands)

	Number of emigrated physicians
India	20.3
UK	12.2
Philippines	9.8
Germany	8.8
Italy	5.8
Mexico	5.6
Spain	5.0
South Africa	4.4
Pakistan	4.4
Iran	4.4
France	4.2
Poland	4.0
Dominican Rep	3.6
Canada	3.4
Netherlands	3.3
Egypt	3.0
Greece	2.8
Ireland	2.7
Vietnam	2.4
China	2.4
Romania	2.3
Syrian Arab Republic	2.3
Malaysia	2.2
Belgium	2.0
Turkey	2.0
Grenada	1.9
Russia	1.9
U.S	1.9
Serbia&Montenegro	1.8
Hungary	1.8

Source: Ratha and Xu (2008)

Information Technology and Bio Technology. However on the negative side, the migration of highly skilled workers has deleterious effect on the potential supply of science and engineering workforce within the country. Further, if these persons had stayed behind rather than migrating abroad would have paid income taxes to the exchequer. If this were to be so their migration has a fiscal implication too. In order to calculate the fiscal losses associated with these emigrants, Desai et al (2007) estimate the counterfactual earnings distributions of Indian high skilled migrants to the USA are generated using two distinct methods and integrated with a model of the Indian fiscal system to calculate fiscal consequences. Conservative estimates indicate that the annual net fiscal impact to India of high-skilled emigration to the U.S.A is one-half of one percent of gross national income (or 2.5 percent of total fiscal revenues). The sensitivity of these results to the method of predicting counterfactual incomes and the implications of these estimates for other developing countries is discussed in detail in their study. So the imperative on the part of public policy will be to maximize the positive effects while minimizing the negative consequences.

Routes of migration: There are essentially two routes through which high skilled migration has actually taken place. The first one or the traditional route is for Indian students to go abroad for higher education and then remaining back in the country where they have studied by taking up employment. The second and new route is for Indians with qualifications secured from Indian institutions of higher learning and taking up employment abroad. A fillip to this route is the H1B visa route that has shot into prominence in recent times.

(a) Education route: Figure 1 maps out the trends in travel abroad by Indian students for education purposes. This can be taken as a surrogate for the number of students going abroad for higher studies as these figures are hitherto not available at all, although after the recent instances of violence against Indian students in Australia, the central

government is in the process of creating a database of Indian students going abroad for higher studies. The figure shows that there has been tremendous increase in the amount spent on travel for education purposes and education related travel now forms about 3 per cent of all such travel to about 30 per cent indicating tremendous increase in out migration. It is evident from a number of disparate sources that most of the students going abroad are for graduate, doctoral and post doctoral studies although in the more recent past a small number of students are proceeding abroad even for undergraduate studies as well.

Most of the students who go abroad for higher studies proceed to English speaking worlds of the US, the UK, Australia, New Zealand and Canada to a lesser amounts to continental European countries such as the Netherlands, Germany and France[1]. Going to Russia, other East European countries and even to China for medical studies is also heard of. Of all these countries, USA remain, by far, the most important and favourite destination. For the students pursuing higher studies in the US, the National Science Foundation has been maintaining records of their stay rates on a systematic basis for a long period of time. The details of this data set could be found in the successive issues of its publication, the *Science and Engineering Indicators* (National Science Board, 2008 and previous issues). As indicated by Table 4, not only that Indians have one of the highest stay rates among foreign recipients of S&E doctorates, these stay rates are even on the increase for the more recent years.

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1 Most of the universities are now actively recruiting Indian students by having local agents to facilitate both admissions and for simplifying the travel formalities.

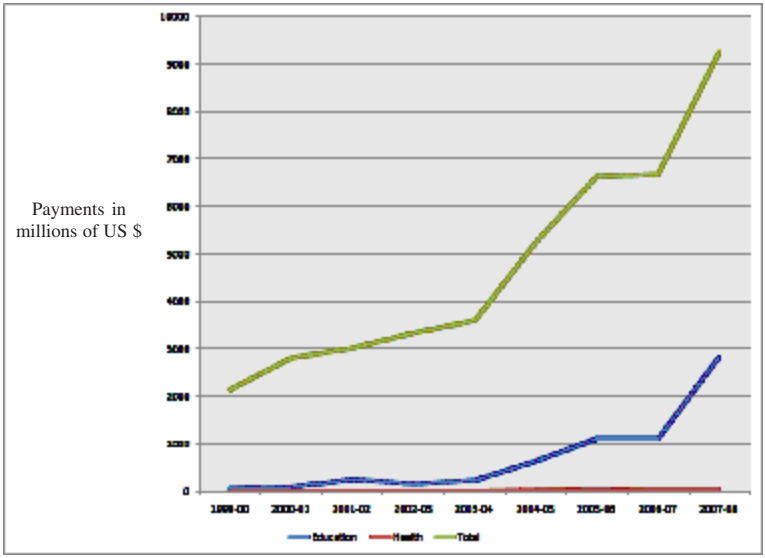

Figure 1: Trends in amount spent on education related travel, 1999-00 to 2007-08

Source: Reserve Bank of India (2009)

Table 4: Plans of foreign recipients of S&E doctorates to stay in the United States, by field and place of origin: 1994-2005

	Plans to stay (%)			Definite plans to stay (%)		
Field/place of origin	1994-97	1998-2001	2002-05	1994-97	1998-2001	2001-05
All S & E fields						
All non-U.S. citizens	70.9	72	73.8	39.1	49.7	49.3
East/South Asia	76.7	78.5	79.8	42	53.8	52.3
China	95.9	90.9	91.6	51.5	62.1	60.2
Taiwan	56	63.7	65.3	26.7	38.3	38.6
Japan	43.8	54.9	58.8	27.7	35.9	40.8
South Korea	45.4	62.5	69.8	23.9	41.9	43
India	90.5	88.2	88.2	56.3	66.5	62.7

Source: National Science Board (2008)

(b) Employment route[2]: Of late, Indian's with university degrees (primarily in engineering and business management) have been securing jobs abroad through campus and open recruitments conducted by MNCs and by other foreign entities. An industry where most of these kinds of recruitments have been made is the IT industry where the H-1B visa[3] procedure of the US has come in very handy. According to Jachimowicz and Meyers (2002) , the top ten countries of origin for H-1B recipients were: India, China, Canada, the United Kingdom, Philippines, Taiwan, Japan, Korea, Pakistan, and Russia. Almost half of the H-1B petitions approved were granted to individuals born in India, eclipsing the eight percent from China, the second leading country of birth. The largest percentages of all immigrants who adjust to permanent resident status from a temporary worker status come from Asia, specifically China, India, and the Philippines. H-1B workers in particular often adjust to permanent legal status through employment based visas. By one estimate, more than 50 percent of all H-1B workers will adjust to permanent employment-based status by 2010. H-1B workers are not required to demonstrate that they intend to return home, and therefore the law implicitly encourages a transition to permanency. Thus the argument is that most of the high skilled Indians who have migrated to the West are

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2. This section is based on the ideas contained in Jachimowicz and Meyers (2002)

3. The H-1B is a non-immigrant visa in the United States under the Immigration and Nationality Act, section 101(a)(15)(H). It allows U.S. employers to temporarily employ foreign workers in specialty occupations. The regulations define a "specialty occupation" as requiring theoretical and practical application of a body of highly specialized knowledge in a field of human endeavor including, but not limited to, architecture, engineering, mathematics, physical sciences, social sciences, biotechnology, medicine and health, education, law, accounting, business specialties, theology, and the arts, and requiring the attainment of a bachelor's degree or its equivalent as a minimum (with the exception of fashion models, who must be "of distinguished merit and ability".) Likewise, the foreign worker must possess at least a bachelor's degree or its equivalent and state licensure, if required to practice in that field. H-1B work-authorization is strictly limited to employment by the sponsoring employer

in the US through the H-1B route. Consequently they are, technically speaking, temporary migrants. The implications of this could be seen in the quantity of remittances by these skilled workers- a point that will be elaborated in one of the subsequent sections.

III. Economic implications

The literature[4] on migration identifies four channels through which migration can actually impact on the economic performance of the sending country. The first channel captures how the *prospect* of emigration affects the expected return on human capital. The central idea is that the prospect of emigration increases human capital investments, but a fraction of the additional human capital chooses not to leave or does not qualify to leave. The second impact is the absence of highly skilled migrants from the sending country. Research on the absence channel has the longest pedigree. The focus is on how the absence of part of a country's skilled nationals affects the domestic economy. The third channel focuses on the role of the diaspora as a source and facilitator of international business and remittances. This is a burgeoning literature that includes survey work on diasporic networks, empirical estimation of the effect of diasporas and trade, and theoretical exploration of the intermediation function . The general finding is that diasporic networks have a significant effect on international business. Finally, work on the return channel has concentrated on the determinants and selectivity of, and the impact of emigration on returnee's human capital and earnings.

In the present paper, I focus on one dimension of absence and one dimension of diaspora. The dimension of absence is the supply of technically trained manpower for performing R&D. The dimensions of diaspora considered are (i) the private transfers and its effect on containing the Current Account Deficit; and (ii) contribution to IT exports from India.

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4. See Desai et al (2009) for a succinct issue-specific review of this literature.

(i) Absence: Supply of technically trained personnel:

India's total pool of technical manpower is one of the largest in the world. The growth rate of India's IT software industry has been tremendous in the recent past. The country is a growing destination for cutting edge R&D outsourcing in certain high tech areas such as bio pharmaceuticals and telecommunications and the demand in the West for students from India's top science and technology educational institutions has been very strong. Nevertheless India has a very low stock of scientists and engineers engaged in R&D. The density of scientists and engineers engaged in R&D too is one of the lowest among the BRIC countries. How does one explain this state of affairs?

There are essentially three hypotheses that one can put forward as an explanation for this low density of scientists and engineers in R&D.

1. The demand for scientists and engineers is very low as most Indian industries do not invest in innovation. This is indicated by the low R&D intensities. Even the increased patenting is restricted to a few enterprises in the pharmaceutical sector and as such patenting is not widespread. The demand for innovation is low because more Indian industries are highly concentrated. But the recent spate of liberalization has started, albeit slowly, to reverse this trend;

2. The demand for research as a career option even among students with science and engineering degrees is very low. This is directly linked to compensation and working conditions of scientists and engineers even in private sector enterprises. The financial compensation is low and upward mobility is limited compared to other functional areas within the company. As a corollary brain drain is the highest among this category. The state is aware of this and the Science and Technology Policy of 2003[5] has addressed

5. See Department of Science and Technology, http://www.dst.gov.in/stsysindia/stp2003.htm#c5 (accessed on August 15 2009).

this issue in an explicit manner when it states that "The number of scientists and technologists, while being large in absolute numbers, is not commensurate with the requirements in quality and when measured on a per capita basis. The demand is bound to increase in the coming years with more intensive activities involving science and technology. There is need to progressively increase the rate of generation of high quality skilled human resource at all levels. This process would naturally entail reversing the present flow of talent away from science, by initiating new and innovative schemes to attract and nurture young talent with an aptitude for research, and by providing assured career opportunities in academia, industry, Government or other sectors" ;

3. There are supply side problems as well caused by mismatch between what is supplied by the higher education sector and what is demanded by the industry. This is perhaps due to the quality of tertiary education in science and engineering.

Of the three, the one that is most relevant for us is the second hypothesis. Given the low incentives[6] for science as a career a large number of highly skilled Indians have always migrated to the West and especially to the United States as the previous discussion of estimates of high skilled migration had shown us. The ones remaining have 'migrated' to non-engineering professions within the country.

The recent growth performance of knowledge-intensive industries in India is prompting many commentators to feel that India is transforming itself into a knowledge-based economy. The copious supply of technically trained human resource is considered to be one of the most important reasons for this growth performance. However, of

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6. These incentives are not always financial in nature. It can also be the overall work culture prevailing in these scientific organizations characterized by high levels of bureaucracy and inflexibility in addition to being hierarchical.

late, the industry has been complaining of serious shortages in technically trained manpower.

For instance a recent study (2007) conducted by the Federation of Indian Chambers of Commerce and Industry (FICCI) has revealed that the rapid growth in the globally integrated Indian economy has led to a huge demand for skilled human resources. However, lack of quality in the higher education sector has become a hindrance in filling the gap. The survey, based on a study conducted in 25 sectors, also showed that currently there is a shortage of about 25 per cent skilled manpower in the Engineering sector. In addition successive R&D surveys conducted by the Department of Science and Technology has shown that the number of scientists and engineers engaged on a full time equivalent basis on R&D is only about 295000 thus working on a density basis of just 8 R&D scientists and engineers per 10, 000 labour force (Department of Science and Technology, 2006). This shortage in skilled personnel is, once again expressed by National Knowledge Commission (2007).

Although the outturn of engineering and technology students in India (Figure 2) has increased from about 45,000 in 1991 to about 100, 000 in 2002 (latest year for which such data are available), it is seen that only about 60 per cent of those graduating every year are added to the stock of engineering and technology graduates(Table 5). At least part of the unaccounted graduates has migrated to foreign countries either for higher studies or for employment. Consequently this migration, referred to as *brain drain* can have a consequence to the availability of skilled manpower within the country and also for the country to take up R&D projects in certain key technology areas where these skills could have been gainfully employed. However, contrary to the traditional notion of brain drain being a negative phenomenon, the recent growth of certain high technology industries such as IT and BT has shown that the more appropriate term is *brain circulation.* According to Saxenian (2006), engineers who came to Silicon Valley from India, China, Taiwan and Israel are creating business networks, seeding their home countries;

changing the traditional landscape of innovation and allowing Silicon Valley to deepen its managerial and technical know-how. Further research done by Nanda and Khanna (2007) explored the importance of cross-border social networks for entrepreneurship in developing countries by examining ties between the Indian expatriate community and local entrepreneurs in India's software industry. Their study found that entrepreneurs located outside software hubs— in cities where monitoring and information flow on prospective clients is harder - rely significantly more on diaspora networks for business leads and financing. Relying on these networks is also related to better firm performance, particularly for entrepreneurs located in weaker institutional environments. However, data on return migration is notoriously bad. Khadria (1999) has argued that the country could precipitate policies for utilizing the expertise of knowledge workers who have migrated abroad by encouraging them to invest in India through three channels: financial resources, technology transfer and through human resources itself.

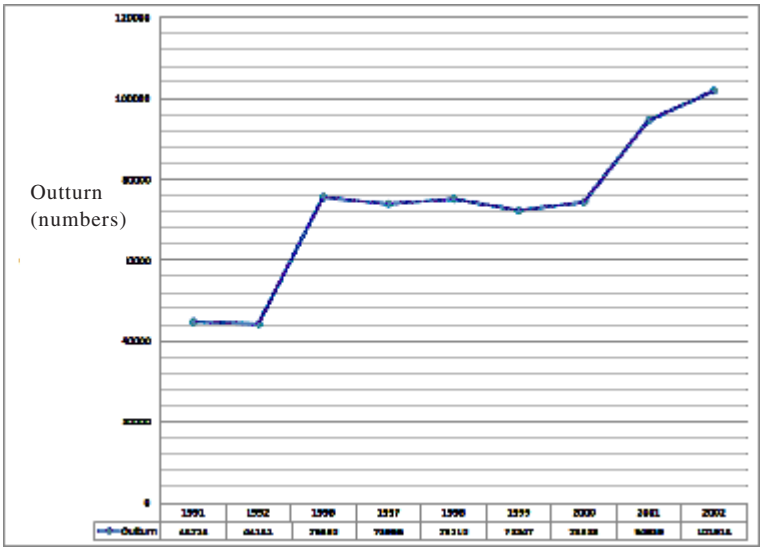

Figure 2: Outturn of engineering and technology graduates in India, 1991-2002

Source: Institute of Applied Manpower Research (2008)

Finally, Pandey et al (2004), lists at least five recent contributions of Indian diaspora to more knowledge development in India.

Box 1: Contribution of Indian diaspora to knowledge development in India

- Since India IT companies (as well as those in other sectors) require a lot of project management and business expertise, the Indian Diaspora started a private school called the International School of Business (ISB). A lot of Indian professors teaching in universities in the US, UK and Canada take one or two term sabbatical and go to teach at ISB.

- Many Indians living in the US, Canada and UK decided to return to India and either join companies like GE, Intel, and IBM in India or start their own companies. Indeed, the number of companies started by returning Indians (in the IT and BPO space) is already over 200.

- The Indus Entrepreneur and the Silicon Valley Bank has already taken two delegations of Venture Capital Companies (who have already invested over 40 Billion USD in the US) to India for exploring potential investment opportunities. Many of these VCs are actively considering opportunities of investing in Indian companies and some have already done so.

- With the rise of the Indian IT industry and the additional push by the Indian Diaspora, many VCs in the US now require their startup companies to have a back-end in India so that they can save on research and development costs. According to Evalueserve's estimates, over 150 startups already have some form of their back-end in India and

front-end in the US (as of March 2004); this number is likely to double by March 2006.

- Some VCs in the US – particularly those of Indian Origin – are actively funding Indian companies who are likely to produce Intellectual Property and innovative products in the areas of wireless technology, semiconductor design and technology, and new business models for conducting Research and Development. Examples include Westbridge Capital, Kleiner Perkins Caulfield & Byers and Norwest Venture Group.

Table 5: Unaccounted engineering and technology graduates within India's total stock of such graduates, 1991-2002 (in numbers)

	Total estimated stock	Actual outturn	Outturn derived from total stock	Un-accounted
1991		44724		
1992		44141		
1996	755971	75650		
1997	811130	73936	55159	18777
1998	865720	75210	54590	20620
1999	926910	72247	61190	11057
2000	988630	74323	61720	12603
2001	1049290	94639	60660	33979
2002	1108950	101914	59660	42254

Source: Computed from Department of Science and Technology (2006) and Institute of Applied Manpower Research (2008)

So from this analysis, it is, somewhat, clear that out migration of highly skilled personnel from India has been beneficial to the country's economy in terms of nurturing and sustaining one of the fastest growing industry, namely the IT industry.

(ii) Diaspora: Growing private transfers to India

In the larger literature on development, the issues of migration and development were hitherto treated separately. However, the two issues are now intimately linked to each other. For instance, lack of development of a specific space (province, region or country) is usually the root cause for people migrating from that space. Further, migration can also lead to development of the sending country through remittances sent by the migrants and through the migrants being a source of knowledge and capital for development projects in their home countries. The role played by the Indian diaspora is often cited as one of the reasons as to why India was able to develop a world class IT services industry.

(a)Remittances: Regarding remittances, we consider six dimensions of it, namely (a) Its size; (b) its composition; (c) relationship between the exchange rate and remittances; (d) country source of remittances; (e) its utilization pattern; and (f) relationship between remittances and high skilled migration. At the outset it may be noted that we use the terms remittances and the more technical variant of it, private transfers, are used interchangeably although it need not be the case[7].

(b)The size of remittances: India now has the distinction of being the largest remittance (in absolute terms) receiving country in the world. See Table 6. There has been a tremendous growth in private transfers to India from just about $2 billion in 1989-00 to about $ 43

7. According to the *World Bank Migration and Remittances Factbook*, the term remittance includes private transfers plus inflows on account of compensation of employees (wages and salaries of citizens of a country on foreign contracts) where the contract period is less than one year. See Ratha and Xu (2008) for the details. But in our study remittance is restricted to private transfers as compensation of employees inflows to India is practically insignificant.

billion in 2007-08 (Table 7). As one of the three components[8] of India's invisible receipts, it has averaged around 89 per cent, although its share in the last two fiscal years has been eroded and now accounts for about 56 per cent. This is due to the fact that there has been a significant increase in miscellaneous service exports, which includes, *inter alia,* software and business services[9]. The sheer size of these transfers could be understood from the fact that even in 2007-08 when India had record net FDI inflows, private transfers still accounted for over 1.2 times the Net FDI to India (Table 7). Further, remittances now account for about 3 per cent of India's GDP although in 1991 it accounted for just 0.7 per cent. They have offset India's merchandise trade deficit to a large extent, thereby keeping the current account deficits modest through the 1990S. Remittances are also one of the least volatile inflow s in either the current or capital accounts of India's BoP.

Private transfers or remittances do not enter Net Factor Income from Abroad (NFIA) which is added to a nation's GDP to arrive at its GNP. This is because remittances are already included in the GDP of the remittance sending countries and so if this amount is added to the GDP of remittance receiving countries it may lead to the double counting of world incomes. Consequently despite these high remittances the ratio of India's GDP to GNP has hovered around 1. Instead, remittances do enter the National Accounts of the receiving countries at the level of net national disposable income (Table 8). As far as India is concerned it now accounts for about 3 per cent of net national disposable income for the country as a whole although its share in large remittance receiving states like Kerala is bound to be higher.

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8. The other two components are services and income.

9. In fact RBI has for the time included a variety of business service receipts for the first time since 2004-05.

Table 6: The Top remittance receiving countries in the world, 2007 (in US $ billions)

Country	Remittances (US $ billions)
India	27
China	25.7
Mexico	25
Philippines	17
France	12.5
Spain	8.9
Belgium	7.2
Germany	7
UK	7
Romania	6.8
Bangladesh	6.4
Pakistan	6.1
Indonesia	6
Egypt	5.9
Morocco	5.7
Lebanon	5.5
Poland	5
Vietnam	5
Montenegro	4.9
Colombia	4.6
Brazil	4.5
Guatemala	4.1
Russia	4
Portugal	3.8
EI Salvador	3.6
Austria	3.5
Nigeria	3.3
Can Republic	3.2
Ecuador	3.2
Australia	3.1

Source: Ratha and Xu (2008)

Table 7: Private transfers to India, 1989-90 to 2007-08 (in billions of US $)

	Receipts	Pay-ments	Net Receipts	Net invisi-bles	Per cent of Net Invisi-bles	Net FDI	Per cent of Net FDI	Per cent of GDP
1989-90	2285	11	2274	1550.3	146.68			
1990-91	2071	12	2059	-242		97	2122.68	0.7
1991-92	3785	11	3774	1620	232.96	129	2925.58	1.58
1992-93	3852	8	3844	1921	200.10	315	1220.32	1.65
1993-94	5273	9	5264	2898	181.64	586	898.29	2.08
1994-95	8087	16	8071	5680	142.10	1343	600.97	2.75
1995-96	8492	27	8465	5449	155.35	2144	394.82	2.4
1996-97	11284	62	11222	10196	110.06	2841	395	3.49
1997-98	11830	45	11785	1007	1170.31	3562	330.85	3.12
1998-99	10280	61	10219	9208	110.98	2480	412.06	2.68
1999-00	12290	34	12256	13143	93.25	2167	565.57	2.7
2000-01	13065	211	12854	9794	131.24	4031	318.88	2.8
2001-02	15760	362	15398	14974	102.83	6125	251.40	3.3
2002-03	17189	802	16387	17035	96.20	5036	325.40	3.4
2003-04	22182	574	21608	27801	77.72	4322	499.95	3.7
2004-05	21075	550	20525	31232	65.72	5987	342.83	3
2005-06	24553	458	24095	42002	57.37	8901	270.70	3.1
2006-07	28951	1010	27941	53405	52.32	21991	127.06	3.4
2007-08	42589	1811	40778	72657	56.12	32327	126.14	3.7

Source: Reserve Bank of India, Database of the Indian Economy

Table 8: Share of private transfers in net national disposable income, (Rs in crores at current prices), 1999-00 to 2006-07

	Net Private transfers	Net national disposable income	Share (%)
1999-00	53132	1808314	2.94
2000-01	58811	1936575	3.04
2001-02	73363	2103949	3.49
2002-03	79229	2266623	3.50
2003-04	104819	2561208	4.09
2004-05	91971	2890085	3.18
2005-06	108565	3283989	3.31
2006-07	126088	3807852	3.31

Source: Central Statistical Organisation (2008)

An immediate effect of these growing private transfers to India is its actual effect in reducing the bourgeoning Current Account Deficits (CAD) (Table 9). In fact it is seen that right from the 1990s, the CAD would have been much higher had the private transfers been not available. For instance, in 2005-06, the CAD without private transfers would have been 4.4 per cent of GDP- almost 3.1 percentage point higher than the actual deficit which includes these transfers.

(c) Composition of remittances to India: Private transfers to India may flow through any of the following four channels (Table 10). These are:

(i) Inward remittances from Indian workers abroad for family maintenance; and

(ii) Local withdrawals/redemptions from non-resident deposits;

(iii) Monetary value of gold and silver brought through passenger baggage; and

(iv) Personal gifts/donations to charitable/religious institutions in India

Table 9: Effect of remittances on India's Current Account Deficit (as per cent of GDP)

Plan period	Trade Deficit	Current Account Deficit including remittances	Current Account Deficit excluding remittances
First(1951-56)	-1	-0.1	-0.6
Second(1956-61)	-3.1	-2.3	-2.7
Third(1961-66)	-2.1	-1.8	-2
Annual(1966-69)	-2.1	-2	-2.2
Fourth(1969-74)	-0.7	-0.3	-0.5
Fifth(1974-79)	-1.2	0.1	-0.7
Annual(1979-80)	-2.8	-0.4	-1.9
Sixth(1980-85)	-3.5	-1.5	-2.8
Seventh(1985-90)	-3	-2.2	-3.1
Annual(1990-92)	-2	-1.7	-2.7
Eighth(1992-97)	-2.7	-1.2	-3.5
Ninth(1997-02)	-3.2	-0.6	-3.4
Tenth(2002-07)	-3.9	0.5	-2.8
2002-03	-2.1	1.3	-2.1
2003-04	-2.3	2.3	-1.4
2004-05	-4.9	-0.4	-3.4
2005-06	-6.5	-1.3	-4.4

Note: * The first four years of the tenth five year plan

Source: Reddy (2006)

Table 10: Composition of remittances to India, 1989-90 to 2 (in Millions of US $)

	Inward remittance from Indian workers abroad for family maintenance etc.	Local withdrawals/ redemption from non-resident deposits	Gold and silver brought through passenger baggage	Personal gifts/ donations	Total Private Trans-fers
1989-90	1880	0	0	405	2285
1990-91	1655	0	0	416	2071
1991-92	3445	0	0	340	3785
1992-93	2334	0	1076	442	3852
1993-94	2767	0	1670	836	5273
1994-95	5404	0	2100	583	8087
1995-96	5196	0	1943	1353	8492
1996-97	4415	3427	2718	724	11284
1997-98	5190	3418	2699	523	11830
1998-99	7608	1859	171	642	10280
1999-00	7423	4120	13	734	12290
2000-01	7747	4727	10	581	13065
2001-02	6578	8546	13	623	15760
2002-03	9914	6644	18	613	17189
2003-04	10379	10585	19	1199	22182
2004-05	8973	9907	27	2168	21075
2005-06	10056	12454	17	2026	24553
2006-07	13561	13208	27	2155	28951

Source: Reserve Bank of India (various issues)

The most important component was remittances repatriated by the overseas Indians for family maintenance: in fact this component accounted for as much as 60 per cent of the total remittances, but its share has since declined to about 47 per cent in 2006-07. Local with drawls from non-resident rupee deposit schemes, which now accounts for the largest share of remittances, are the withdrawals from Non-resident (External) Rupee Account [NR(E)RA] and Non-Resident Ordinary (NRO)

Rupee Account by the non residents or her dependents for local use. Local withdrawals have become very pronounced in the last two years namely in 2005-06 and 2006-07. RBI (2008) attributes this rising trend of local withdrawals to the income levels of migrants, ease of transferring money through NRE deposits and the rising domestic investment opportunities of the remaining two components gold and silver brought as passenger baggage was important only up to 1997-98 or so. This was a direct outcome of certain liberalization of rules wrt importation of gold whereby certain nominated agencies and the NRIs were permitted to import gold under different arrangements.

(d) Appreciation of exchange rate and the quantum of remittances: The Indian Rupee has continuously appreciated since July of 2006. Nevertheless there has not been any slackening of the remittances excepting for the second quarter of 2006-07 and the first quarter of 2007-08. This is an interesting finding namely that even when the Rupee became stronger there has not been any concomitant fall in the quantity of remittances as the theory would predict (Table 11).

Table 11: Relationship between remittances and exchange rate
(Quarterly data, Remittance values are in millions of US $, Exchange rate is the amount of Rupees per 1 US $)

	Remittances	Percentage change	Exchange rate	Percentage Change
2006-07 Q1	6894			
2006-07 Q2	5371	-22.09	46.37	
2006-07 Q3	7257	35.11	44.99	-2.98
2006-07 Q4	8419	16.01	44.17	-1.82
2007-08 Q1	7531	-10.55	41.23	-6.66
2007-08 Q2	9218	22.40	40.52	-1.72
2007-08 Q3	10792	17.08	39.46	-2.62
2007-08 Q4	13237	22.66	39.82	0.91

Source: Reserve Bank of India, Database of the Indian Economy

The above exercise, though preliminary, suggest that remittances respond more to interest rates and investment opportunities in the home country vis-à-vis the sending country than to movements in the exchange rate of the home country. Needless to add this proposition needs a much more rigorous econometric exercise dealing with determinants of remittance inflows before firm conclusions can be drawn.

(e) Diversification of the source base: Traditionally the remittances were linked to the migration of semi-skilled and low skilled Indian workers to the gulf countries. Most of these workers had dependents back home and this increased their propensity to remit part of their income home. According to Reserve Bank of India (2006) demand for semi-skilled and unskilled labour from the gulf countries started in mid 1970s and peaked in the early 1980s, which was followed by the second wave during the mid 1990s led by the Information Technology boom. Thus there has been qualitative change in the pattern of migration from unskilled/semi-skilled to high skilled workers primarily to the United States. According to the detailed BoP tables released by the RBI, the prominence of the dollar area started from around 1994-95 when it accounted for about 30 per cent of the total remittances received by the country. The share of the dollar area has since increased to almost 44 per cent in 2006 (Reserve Bank of India, 2006). The increase in the share of the dollar area has been at the expenses of the gulf countries. See Table 12. This change in the distribution of the source regions has implications for the relative share of various states in the total remittances to India. It is quite likely that the share of Kerala may have declined because even now (c2006) remittances from Gulf countries account for about 56 per cent of the remittances to Kerala, while remittances from North America accounts for only about 18 per cent of the total remittances to that state. See Table 13.

Table 12: Region-wide source of remittances to India (c2006)

	Percentage
North America	44
Gulf Countries	24
Europe	13
East Asia	8
South America	6
Africa	2
Others	3

Source: Reserve Bank of India (2006)

Table 13: Source regions of remittance flows in various regional centres, c2006 (percentage share in total remittances)

Centre	Gulf Countries	North America	South America	Europe	Africa	East Asia	Others	Total
Ahmedabad	16	41	7	20	5	5	6	100
Bangalore	20	70	3			6	1	100
Kochi	56	18	6	14	2	2	3	100
Chennai	29	44	6	11	1	8	1	100
Chandigarh	16	37	9	30	1	6	1	100
Delhi	9	55	4	15	3	10	3	100
Hyderabad	19	65	8			5	3	100
Jaipur	38	45	1	5	1	11	0	100
Kolkata	15	38	6	21	4	9	7	100
Mumbai	25	31	8	15	3	14	4	100

Source: Reserve Bank of India (2006)

An interesting result thrown up by the above facts is that although the skill content of international migration from India has increased since the mid 1990s, this has not led to any reduction in the quantum of

remittances. This is a surprising result because the received wisdom from the literature on international migration shows that high skilled migration is usually associated with a reduction in the propensity to remit[10]. While skilled migrants typically earn more, and so might be expected to remit more, they are also likely to spend more time abroad and to reunite with their close family in the host country. These second two factors should be associated with a smaller propensity to remit. On the contrary, there is also second finding that skilled migrants raise economic welfare at home by sending a relatively larger flow of remittances. Thus, the sign of the impact of the brain drain on total remittances is an empirical question. In the Indian case, we argue increased high skilled migration from India has had a positive impact on the quantum of remittances. This is argued out in the last sub section.

(f) Utilization pattern of remittances: Worker's remittances can actually enhance consumption or investment or both. However, the empirical evidence on this aspect from a variety of countries presents a mixed picture and there is no consensus has been reached in the literature. A recent survey conducted by the RBI in 2006 showed (Table 14) that majority of the remittances are used for family maintenance, while about 20 percent is kept in banks as deposits. Only about 10 per cent is invested and that too in land and property. The important finding is that hardly anything is invested to create fixed assets in the industrial sector. To the extent that much of the remittances are used to finance consumption and the fact that consumption is one of the pillars on which the present high economic growth of the country is built the fact that the remittance are largely used to finance consumption is not necessarily a worrisome factor as it is made out to be. Also remittances parked in the form of bank deposits may ultimately find its way to investments in industry and trade and this crucially depends on the opportunities for such investments. Some of the larger remittance

10 See Faini (2007) for a review of this literature.

receiving states such as Kerala has not been blessed with a conducive industrial investment environment: in fact investment intentions in the state cumulatively from August 1991 through June 2008 works out to an insignificant 0.32 per cent of such investment intentions that have been expressed in India as a whole (Department of Industrial Policy and Promotion, 2008). Given this sort of a background one may not expect the migrants to commit their savings to industrial investments. Although this issue has been widely discussed very little appears to have been done by the investment promotion agencies at the state level to encourage their own respective non resident citizens to invest in productive assets. This is an area where urgent public policy action is required.

Table 14: Utlization pattern of remittances in India, c2006

	Percentage
Family maintenance	54
Bank deposits	20
Investment in land and property	10
Investment in equity shares	3
Others	13

Source: Reserve Bank of India (2006)

IV. Summing up

There are both direct and indirect evidence to show that high skilled migration from India has increased during the post liberalization period- a phase when market opportunities had actually increased. The traditional education route which Indians had followed through for a very long time has been supplemented with an employment route. However, contrary to the old notion of brain drain, which characterized such movement of skills across the nation's borders, the current thinking is in terms of brain circulation. In fact, even in official policy circles the emphasis is is on how to take advantage of this resource for the nation's development of especially a number of high technology industries. The

papers focused on two specific economic implications of this high skilled migration, first its effect on the availability of science and engineering personnel and second its effect on private transfers to the country. On the former, our analysis showed some possibilities of the contribution of high skilled migration to the reduced availability of science and engineering personnel, it is quite possible that a number of graduates with science and engineering may have opted for non science and engineering careers. This is, as it is often argued, due to the relative incentive schemes for science and engineering vs. non science and engineering careers. Fortunately there is appreciation of this problem in policy circles as the Science and Technology Policy of 2003 has explicitly acknowledged this as a constraint and has through the central government's annual budget putting in place a number of financial schemes for incentivizing science and engineering as a career option at least in the public sector. The budgetary allocation for science and technology has registered a nominal growth rate of about 14 per cent per annum over the last ten year period ending 2009-10. Hopefully with more and better opportunities migration of highly skilled personnel from India may not be interpreted as a brain drain issue. Finally remittances by highly skilled migrants have formed an important component of India's private transfers and these growing private transfers have played a very important role in containing India's current account deficits. In short migration of highly skilled India's, on balance, have had more positive economic implications than ever before and public policy ought to be addressed for capitalizing from this cross border movement for the further growth of the nation's economy.

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